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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

GREASES

Part I

Their Manufacture

PUBLISHED BY

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FOR THE TEXTILE INDUSTRY

LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

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GREASES

PART I—THEIR MANUFACTURE*

THE use of greases has become so diversified in modern industry that large suppliers manufacture well over a hundred different products in order to meet the many demands.

Greases, for example, are required to lubricate:

Aircraft controls subjected to temperatures as low as —100° F. in the stratosphere.

Paper manufacturing machines which usually necessitate a water insoluble product.

Steel mills for which extreme pressure qualities are demanded.

Electric motors which normally require a product having low starting and running torques combined with high resistance to oxidation.

Construction machinery which is exposed to dirt and water in all kinds of weather.

These are only a few of the many uses to which greases are put.

No single grease has been developed which might be termed a "Universal Grease," although this is the ideal goal of every grease research chemist. Progress is constantly being made in this direction and today greases are on the market which would have been considered almost impossible to make several years ago.

GREASE, as defined by The American Society for Testing Materials, is "a semi-solid combination of petroleum products and a soap or mixtures of soaps with or without fillers, suitable for certain types of lubrication."

Actually, all greases are an intimate dispersion of soap and oil, which below their melting point are solidified if enough soap is used. The amount of soap necessary to produce solidification depends upon the type of saponifiable ingredient as well as the metallic base used.

Greases are made by dispersing soap (either pre-formed or made "in situ") with a mineral oil by the use of heat and agitation. This results in a supersaturated solution of soap and oil at the higher temperatures and the "grease" structure is formed as a result of cooling this aggregate.

The fact that greases have obtained such popularity in modern industry is due entirely to the fact that they offer more economical lubrication under certain conditions where oil cannot be used to advantage. These conditions normally exist where the bearings are inaccessible for frequent relubrication, where they must be protected from contamination such as dirt or water, or where oil would leak out of the bearing housing.

Greases have many other inherent properties which, in certain specific instances, makes them more desirable than oil; to better understand these it is necessary to have a fundamental knowledge of the part each ingredient in a grease plays and the method of manufacturing greases.

*Part II covering the Characteristics and Uses of Greases will appear in the July 1945 issue of Lubrication.

Fig. 1—The many oils used in grease manufacture are stored in large tanks near the grease plant.

EFFECT OF INGREDIENTS ON THE CHARACTERISTICS OF A GREASE

Greases are fundamentally an intimate dispersion of soap and oil alone, or in combination with certain additives, the latter being added at times to impart certain desirable properties to the finished grease. To better understand the effect of each ingredient on the properties of a grease, a brief summary of their functions is given below:

Soap

The primary purpose of soap in a grease is to serve as a thickener for the oil, not only at room temperature but throughout the entire temperature range in which greases are used. Different soaps, however, have radically different effects on the final product.

Soap results from the chemical reaction (usually termed saponification) of a fat or fatty acid and an alkali, such as the hydroxide of sodium or calcium.

The alkali used is a predominating factor in the resultant qualities of the soap and ultimately the grease. For example, soap made from calcium hydroxide is insoluble in water and usually results in a grease which is smooth, buttery and has a melting point of approximately 180° to 225° F. On the other hand, soaps made from sodium hydroxide produce greases which may be fibrous or stringy, have melting points ranging from 300° F. to 400° F., or higher, and are popularly termed soluble in water.

The choice of fat or fatty acid used in the manufacture of soap contributes materially to the final properties of the grease. For example, some have a tendency to give larger yields of grease; that is, the necessary hardness in the final grease can be obtained with a smaller percentage of soap. Others affect the melting point, appearance, tendency to bleed oil and oxidation characteristics.

Fatty ingredients used in the manufacture of greases are obtainable from all animals and from many of the seeds and fruits of plants and vegetables. The most common are obtained from animal fats; for example, lard, tallow, stearic acid, wool grease, sperm and hydrogenated fish oil. The more common vegetable fats are: rapeseed, cottonseed and olive oil.

Oil

The second major component in a grease is the mineral oil. In the choice of this there is available all of the hundreds of oils produced from petroleum. If a grease is being planned for light duty machinery, a low viscosity light-colored oil is chosen. If, however, a lubricant is being planned for heavy equipment, such as dredges, locomotives, etc., a heavier mineral oil may be chosen. Generally speaking, a grease is selected for use in a bearing containing the same viscosity oil as would an oil, if the bearing were oil lubricated. Notable exceptions to this very broad rule are encountered at extremely low or high operating temperatures and will be explained in more detail in the second article of this series.

Stabilizers

Certain soaps and oil are not compatible and in such cases a third ingredient, termed a stabilizer, is added in small amounts which results in the three ingredients, soap, oil and the stabilizer forming a stable grease.

An example of the importance of stabilizers can be found in ordinary cup greases which are composed of a calcium soap and oil. These two ingredients usually will not mix to form a grease unless a small amount of stabilizer, in most cases water, is added. This is one of the reasons why cup greases stabilized with water cannot normally be used much above about 175° F., for above this temperature the water evaporates rapidly and as a result the oil and soap tend to separate.

Chemical stabilizers with boiling points well above 212° F. have been used successfully in grease manufacture, and several greases of this type are on the market today.

Chemical Additives

Present day trends of industry towards heavier loads on bearings, increased speeds, higher operating temperatures, etc., necessitate the use of additives in specialized cases to impart extreme pressure characteristics, oxidation resistance, rust prevention, tackiness and other more desirable characteristics to greases than can be obtained with a grease containing soap and oil only. As time goes on the use of additives in greases will grow.

Mineral Additives

Graphite, talc and asbestos are sometimes incorporated in greases when such products are to be used as heavy duty lubricants where high temperatures or washing action may tend to remove the grease and leave behind a film of the mineral additive which will prevent seizure.

Graphite is, by far, the most popular mineral additive used in greases; it serves two purposes. First, when used on semi-finished type plain bearings, it tends to fill in rough spots, thus giving a smoother bearing surface. Second, graphite, commonly termed a "solid lubricant," has some friction reducing value.

This product, which may be purchased in many forms and states of purity, does not enter into any combination with the grease, the grease acts only as a carrier. For precision lubrication, such as on ball bearings, graphite is considered to be an abrasive, but for heavy work, such as roll necks in steel mills, curve rails and fifth wheel lubrication of truck-trailers, the addition of graphite is sometimes beneficial.

There are other cases where a grease may act as a carrier for an inert material, a typical example being pipe thread lubricant, which is normally a mixture of a calcium soap grease and metal dust such as zinc, or metal oxides.

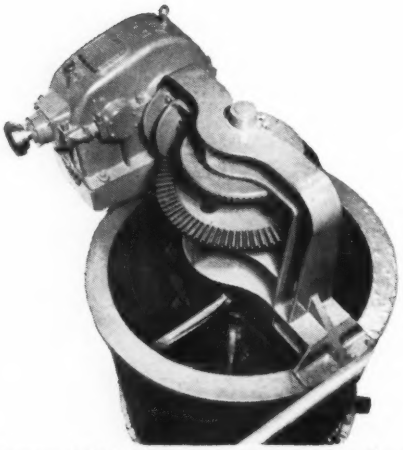
METHOD OF GROUPING GREASES

Generally speaking, the type of soap used in the manufacture of greases has much more to do with the appearance and properties of a grease than does the oil. It is for this reason that the type of soap in a grease is generally used as a basis of classification.

Most commercial greases today can be classed in seven groups. These are as follows:

1. Calcium soap base or cup grease.
2. Calcium resinate soap base or axle grease.
3. Sodium soap base grease-general.
4. Sodium soap base — brick grease.
5. Aluminum soap base grease.
6. Lithium soap base grease.
7. Mixed base greases.

Fig. 2—The cleanliness of modern grease plants contributes materially to the high quality of present day greases.



Courtesy of Buflovak Equipment Division, Blau-Knox Company.
Fig. 3—1700 gallon, plant size, steam jacketed grease kettle.

These are the more common types of greases on the market today, although many other types have been made experimentally and a few have found their way to commercial markets. Greases made from barium, for example, are comparatively new. These have a complex manufacturing procedure and certain inherent properties which, to date, have limited their popularity.

Lead soap is used to a limited extent in the manufacture of greases. This soap has peculiar properties in that it increases the load carrying capacity and imparts corrosion-resistant properties to the finished product. It does not materially "thicken" the oil, however. The above properties makes this soap suitable for use in gear lubricants but since the latter are not within the scope of this article, a discussion of lead soap base products is not included.

METHOD OF MANUFACTURE

The manufacture of greases is one of the most scientific operations performed by lubricant manufacturers because the amount of ingredients used are all very accurately controlled and the reactions involved are entirely chemical in nature. Even though the rate of reaction, amount of ingredients and their purity are carefully controlled by modern weighing and measuring devices, and scientific laboratory control, a certain amount of "art" is required in the manufacture of greases to impart to them the exact texture and other physical properties desired. It is

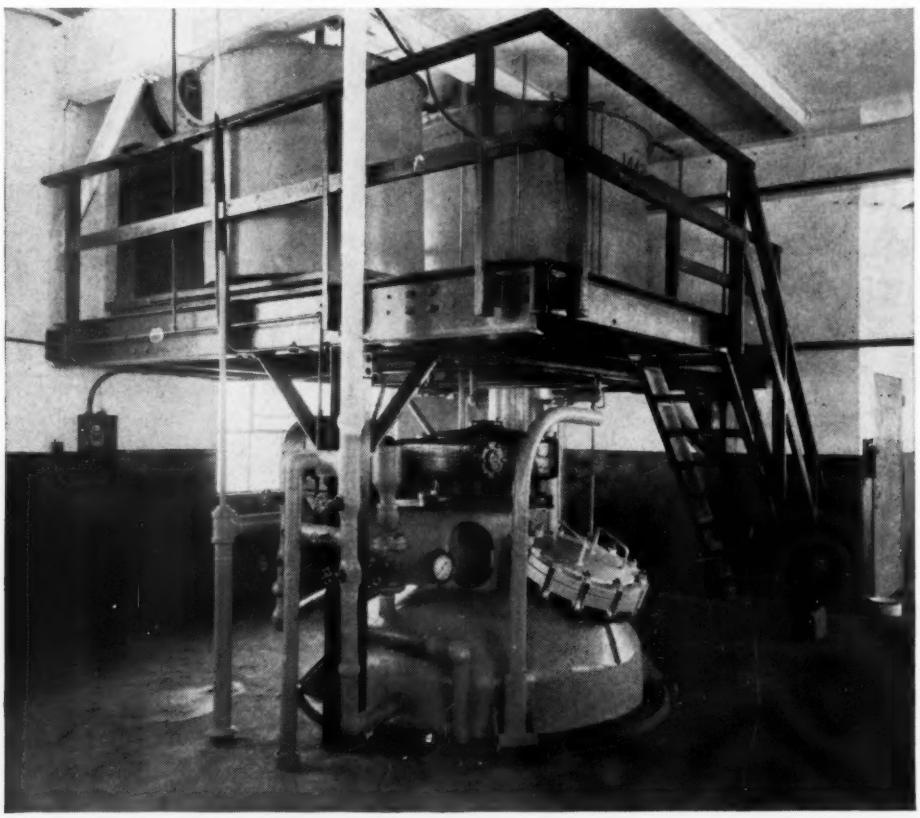


Fig. 4—Top view of a pressure kettle. The tanks above are mounted on platform scales to insure accurate measurement of ingredients going into the kettle.

for this latter reason that expert greasemakers in cooperation with trained laboratory personnel are required to produce high quality greases.

The greasemaker, for example, must know exactly when to add each ingredient for some greases are very sensitive to small deviations in their manufacturing procedure and it is possible to produce two greases, both containing the same amount of each ingredient, but one satisfactory and the other not, by changing their manufacturing procedure slightly.

The basic procedures used in grease manufacture are relatively simple, and are fundamentally of two types: (1) Cooked and (2) Cold mixed, or Sett greases.

Practically all the greases on the market today are of the cooked type; these in turn may be split into two types, i.e.

(a) those which are stirred in the kettle until they are practically cool then drawn into containers and

(b) those drawn into containers from the kettle above the melting point of the final grease.

Sett greases are more easily made than any other type. The procedure used consists in mixing the ingredients at room temperature, drawing the mixture into final containers immediately and allowing the reaction to take place in the containers.

GROUP No. 1
CALCIUM SOAP BASE OR CUP GREASE*

There is definite evidence to show that a lubricant composed of fat and lime was used as early as 1400 BC on the wheels of chariots; however, it was not until about 1845 that lime soap was combined with mineral oil to form a grease. Today, greases in this group are widely used for line shafting, water pumps, plain bearings, and all general applications where the temperature does not exceed 150° to 200° F., depending on the soap concentration. These greases are particularly desirable where water resistance is a factor since calcium soap is insoluble.

Calcium soap base greases can be and are made from a great variety of oils ranging in viscosity from light spindle oils to heavy cylinder oils. By varying the soap content they can be made in grades ranging from liquids to solid greases which can be cut with a knife. The viscosity of the oil used affects the texture of the finished product to some extent in that low viscosity oils give a buttery texture whereas, high viscosiy oils tend to make a grease which is a

*"Lime soap base" and "calcium soap base" are one and the same. Industrial men usually prefer the term lime while chemists use the name calcium.

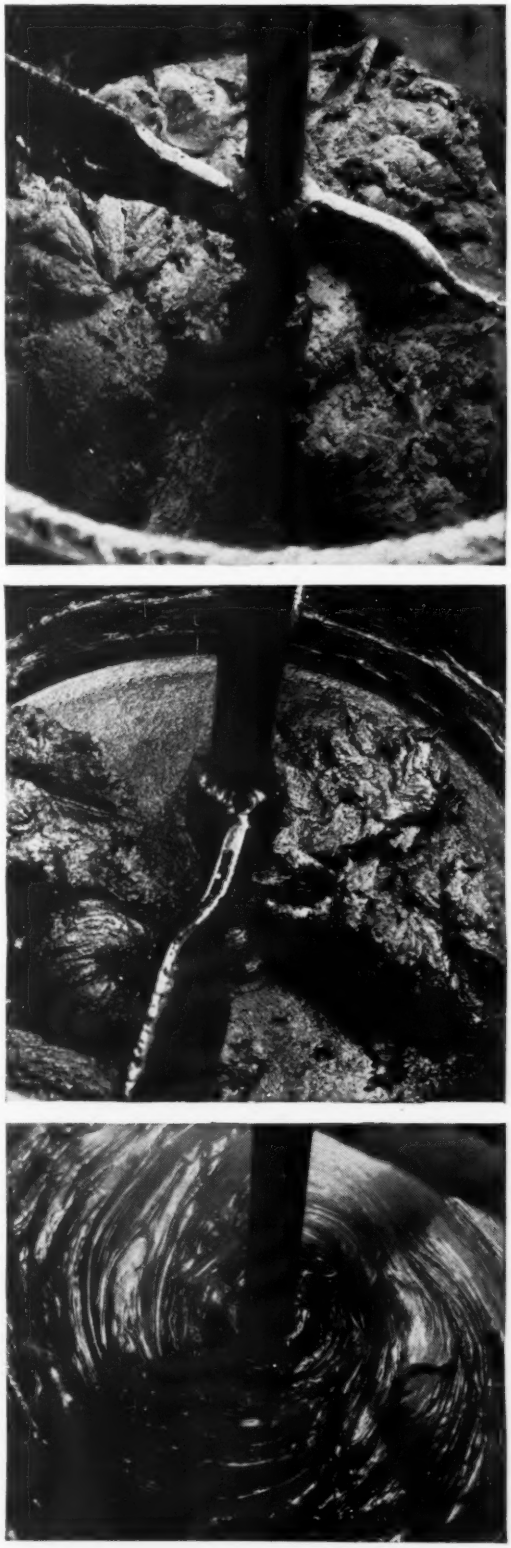


Fig. 5—Various stages in the manufacture of a sodium soap base grease. Top: Soap before the addition of oil. Middle: Soap to which has been added a portion of the oil. Bottom: Finished grease ready to be drawn.

Fig. 6—Small plant size kettle for manufacturing miscellaneous greases.

little more stringy or sticky. Obviously, cup greases prepared from low viscosity oils are designed for light duty service, while higher viscosity oils are required in cup greases to meet heavy duty requirements.

One of the simplest methods of manufacturing cup grease consists of first adding a calculated amount of saponifiable fat (or fatty acid) to a kettle. Next the requisite amount of lime to be used is suspended in a quantity of water in a separate tank, mixed well, then added to the fat. During this step, and all subsequent ones, until the finished grease is drawn into containers, the mixture is constantly agitated.

After the lime suspension has been added to the fat, heat is supplied to induce saponification, which progresses fairly rapidly at 212° F. At first a doughy mass is formed which gradually becomes thicker as the water is evaporated off. When saponification nears completion, the temperature of the mass may rise to around 275° F. at which time the soap assumes an appearance of a heavy syrup or taffy. It is at this point that the skill of the greasemaker begins to play an important part. Upon his ability to judge the appearance and feel of the soap as to when it is time to begin adding oil is one of the important points which determines the success of manufacturing cup greases.

When the soap is judged properly cooked, oil addition is begun and is continued until such time as very nearly the necessary amount has been added. At this point the mass has been cooled to below 200° F. but is still sticky in appearance. When the batch is considered just right by the greasemaker, a predetermined amount of water is added and the batch almost immediately assumes the typical appearance of cup greases. After the water has been added and stirred in, a sample of the grease is sent to the laboratory for control tests. The water content of the batch may have to be adjusted in order to obtain proper compatability of the soap and oil, for if there is a deficiency, the grease will be grainy whereas, if too much water is present the product will be dull or milky in appearance.

The greasemaker's skill is also needed in judging the consistency of the batch. He is working with hot and comparatively thin grease, and his problem is to adjust the composition of the product so that after the batch is cooled in the final shipping containers, it will be "on test" for consistency. He does this by removing a sample of grease from the kettle, which he cools to the proper temperature and then determines its consistency by means of an instrument known as a penetrometer. If this test indicates the

grease to be too hard, more oil is added and the above procedure is repeated until the grease is found to be "on test." After the batch is finished in the kettle, it is ready to draw into drums or smaller packages.

The foregoing procedure is fundamentally the same as that used by practically all manufacturers of this type of grease, but there are many variations which can be, and are used. For example, the time for saponification in the above procedure is at least six hours and varies to a great extent with the type of fat used. However, if a pressure kettle is used, complete saponification is brought about much more rapidly.

A second variation often used is to add a portion of the mineral oil with the original charge. This prevents the soap from becoming too hard, particularly when fatty acids are used as the saponifiable ingredient, and materially reduces the power consumed in stirring. The order in which the ingredients are added also plays a major part in the final properties of a grease.

In addition to the foregoing procedures, there is one termed the "cold mixed" or "Sett" process which is sometimes used. In this method, fatty acids in a portion of the oil are mixed with a slurry of hydrated lime and the balance of oil, the reaction being carried out at about 100° F. One disadvantage to this method, however, is that the reaction is not complete when the grease is drawn into packages, the balance taking place in the containers. Therefore, these greases may alter their appearance or change their consistency after being packaged. Greases made from rosin oil and manufactured by a process similar to this are used for certain types of application and are discussed under a separate heading.

GROUP No. 2
CALCIUM RESINATE SOAP BASE OR AXLE GREASE

Calcium resinate (often termed lime rosin) soap base grease from the standpoint of composition could be considered cup greases for in this type rosin oil is used instead of one of the usual saponfiable fats incorporated in cup greases. Their method of manufacture and properties differ so radically from cup greases, however, that usually they are considered as a separate group. Rosin oil, incidentally, is a product made by distilling or otherwise processing pine rosins, it contains an appreciable amount of rosin acids.

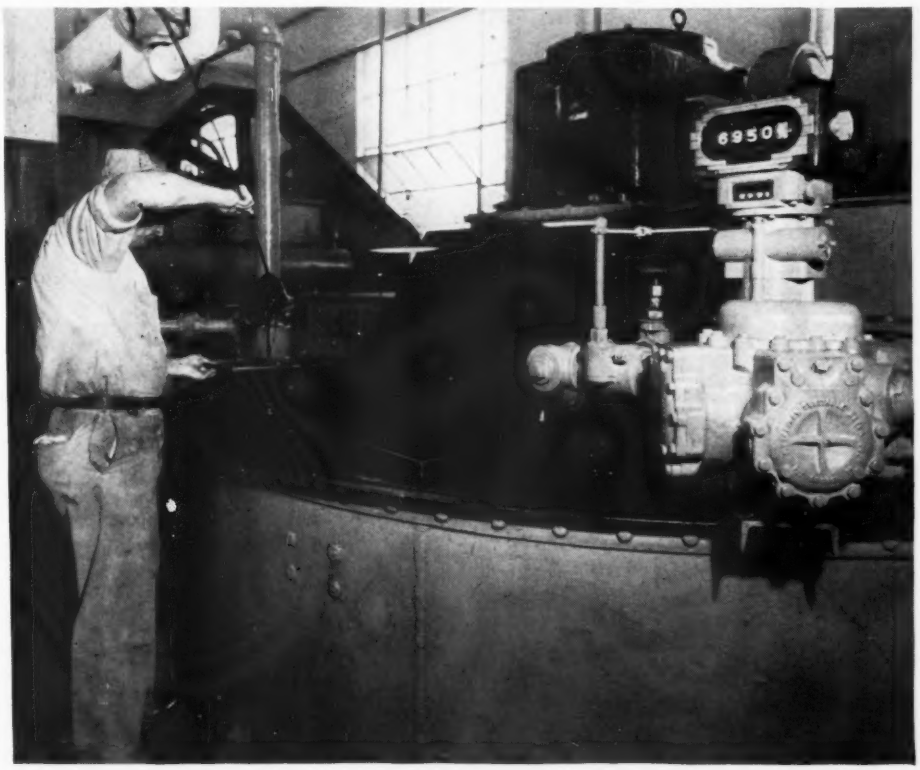


Fig. 7—Removing a sample of grease from kettle for control penetration test. Note the metering device at the right used to accurately measure the oil added to the soap.

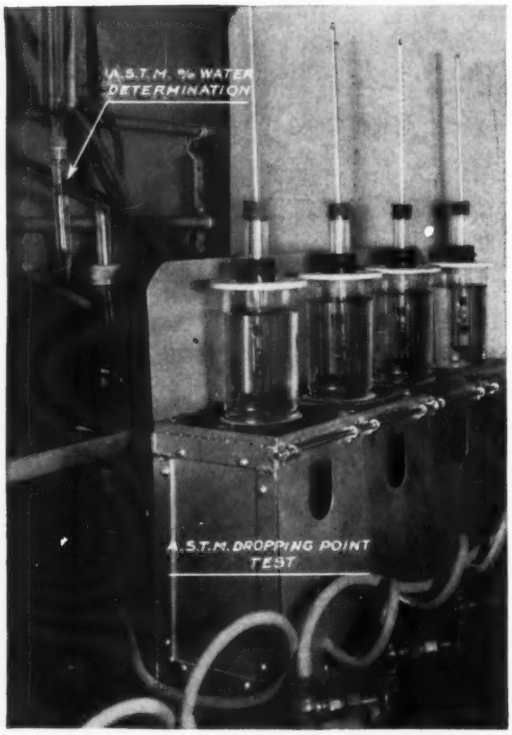


Fig. 8—Typical laboratory tests used to control the quality of finished greases.

Greases in this group are very easily made, requiring no external source of heat to manufacture. They are often used where economy is of primary importance, or where it is necessary to use an excessive amount of grease to prevent dust and other foreign matter from entering bearings. Typical application examples are: rough heavy bearings in lumber or mining equipment, track curves and wagon axles.

The term "Sett" is applied to this group of greases inasmuch as they are usually made by mixing the necessary ingredients in the cold then drawing the contents of the mixing kettle rapidly into containers. The reaction between the lime and rosin oil occurs very rapidly so that the mixture becomes solid or "setts" within several minutes after mixing.

The ingredients used are mineral oil, rosin oil, lime and sometimes water. The rosin oil is mixed in the proper proportion with mineral oil, forming what is known as "Compound." A second mixture consisting of an emulsion of hydrated lime and mineral oil, (in some cases water and a very small amount of rosin oil are incorporated) is made in a separate tank, this mixture being known as "Sett." The "Compound" and "Sett" are agitated in a mixing tank in the proper proportions and poured at once into the final container.

The speed of the reaction depends particularly on the quality of the rosin oils used, for this reason they are usually purchased on the basis of strict specifications.

In order that the reaction between the lime and rosin oil can be carried out efficiently, it is necessary that the grease contain some water and also excess lime. The water serves as the medium in which to carry out saponification and the excess lime insures completeness of saponification. In the finished grease as much as 5% water and 1 to 2% excess lime may exist. The presence of water limits their application to bearings operating below 200° F.

The consistency of "Sett" greases can be varied from semi-fluid products to hard brick type greases. The texture of these greases is somewhat similar to that of cup greases for they are smooth and buttery but are ordinarily more sticky and unctuous.

GROUP No. 3
SODIUM SOAP BASE GREASE — GENERAL

Sodium soap base greases are normally of two types, (1) those drawn from the kettle at temperatures below the melting point of the grease and (2) those drawn in a molten stage; (the latter are described in the next section).

Greases of the first type are often termed "Sponge Grease." This name originated in the early days of grease manufacture when it was thought greases in this group actually resembled a sponge and soaked up the oil in a manner similar to a sponge soaking up water. This theory has since been found to be untrue since the structure is actually such that the oil cannot be squeezed out of the soap.

Characteristics which make this type of grease valuable as a lubricant are their high melting point (300° to 450° F.) and their ability to remain in a bearing at high temperatures and pressures. Most sodium soaps are soluble in water, but whether or not greases made from sodium soaps can be used satisfactorily in the presence of moisture will be determined by other characteristics of the grease and the application itself. In some applications the solubility of the soap may be a decided advantage.

The procedure used in the manufacture of sponge type greases is essentially the same as that used in the production of cup greases. The kettle is first charged with a small amount of oil and the fat, which is then heated until it melts (if it is a solid at room temperature). Next a solution of caustic soda in water (sodium hydroxide) is added in a predetermined amount. The fat is quickly converted to sodium soap and then the contents of the kettle are gradually heated to about 300° F. in order to complete saponification and to evaporate the water. At this point, the soap is firm, tough, spongy and has a tendency to agglomerate in masses about the stirring mechanism. (See Fig. 5, Page 49.)

Here again the skill of the greasemaker contributes materially to the final nature of the finished grease, for it is at this point that the addition of oil is begun. Great care must be taken during the early stages of oil addition to prevent the formation of lumps in the grease. Addition of oil is continued until nearly all has been added, at which point the temperature will have dropped to about 200° F. The grease is then put "on test" in the same manner as for cup greases; that is, by removing a sample and running a control penetration, then adjusting the mineral oil content accordingly.

The fibrous nature of the final grease is mainly controlled by the type of fat or fatty acid used and the procedure of handling the grease in the kettle, particularly during the last stages. Fats, such as tallow, are ordinarily used to produce a grease with a fibrous texture. Fatty acids on the other hand result in a smoother textured product.

Although most unctuous sodium base greases on the market today are of a fibrous nature, it is possible to make them almost as smooth and buttery as cup greases by milling or by the suitable choice of fatty material as mentioned above. Merely milling a fibrous grease to produce smoothness results in a product which is smooth in the container but which may revert back to a fibrous nature upon heating and working.

Cold sett sodium soap greases can be made in a manner similar to cold sett calcium soap base greases. This type is manufactured by merely mixing fat, oil and caustic solution in proper proportions at about 110° F. then drawing the product while still liquid into containers where saponification takes place. Greases of this type are usually made with a high soap content and are, therefore, hard solid products. They can be used for rod cup and driving journal lubrication of railroad locomotives, but since one of these ingredients is water, they should not be used above about 180° F. This type of grease is not extensively used at the present time but was very popular prior to 1915.

GROUP No. 4
SODIUM SOAP BASE — BRICK GREASE

In discussing greases in the previous group, mention was made that this type is drawn from the kettle at temperatures well below the melting point of the grease. If heating is carried to a temperature sufficiently high to cause the soap to dissolve in the oil, and it is then drawn from the kettle, a smooth-textured product results upon cooling which is hard and firm for high soap contents. Lower soap contents result in a false bodied product which appears to be hard but softens readily upon working.

The ingredients used in the manufacture of soda brick greases depend upon the type of product to be manufactured. Tallow is widely used as the fat; while rosin, degras and other fatty materials also may be used.

The mineral oils used in this type of grease depend upon the type of service for which the grease is intended. Since greases in this group are normally used for high temperature, heavy duty work, the oil incorporated in the grease is usually of a heavy grade, although some brick greases are made with much lower viscosity oils.

Soda brick greases are ordinarily manufactured to a definite soap concentration and hence no manipulation of the batch is necessary in order to put the grease "on test."

Brick greases find application in high temperature and heavy duty lubrication such as on journals of

Fig. 9—Every container is thoroughly inspected just before it is filled.

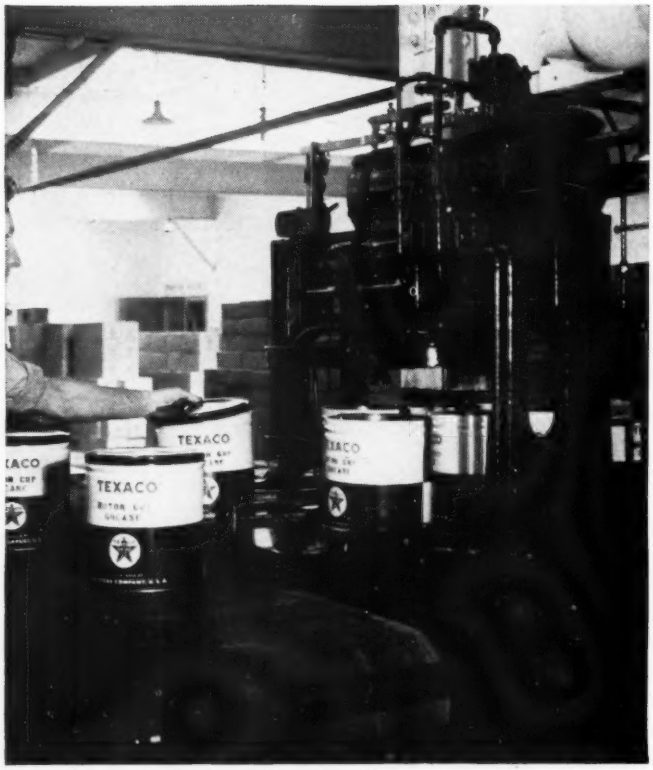


Fig. 10—Twenty five pound can filling machine. Covers are placed on the cans immediately to prevent possible dirt contamination.

cement and paper mills, locomotives, etc. The grease is ordinarily applied in brick form directly on the journal.

GROUP No. 5 ALUMINUM SOAP BASE GREASES

Greases in this group are almost invariably made by thickening mineral oil with aluminum stearate. This soap may be prepared in various ways; however, the most common is known as the double decomposition method. The fat, which must be largely, or completely, a stearate, is saponified with caustic soda. The resultant soap is maintained in a liquid state and a solution of alum is added; the alum combines with the sodium soap and forms aluminum stearate, which is insoluble in water. After washing the aluminum soap free of excess chemicals, it is dried.

Aluminum soap greases are made by charging aluminum stearate and a portion of the oil to a kettle, then heating until the soap melts and dissolves in the oil to form a clear mass. At this point the rest of the oil is added,

Fig. 11—Drums of grease ready to be shipped.

the heat turned off and the mass stirred until partially cooled. It is then drawn into cooling pans.

One difficulty with aluminum soap base greases is that the rate of cooling affects the finished products. If cooled too fast, they are crumbly; if cooled too slowly, they are too soft. In order to avoid this, the grease should be cooled under controlled conditions and then passed through a mixer (milled) which produces a smooth, glossy and transparent product.

The undesirable property of texture change with variations in temperature is mainly responsible for the limited uses for products of this type on the market today. Unfortunately, when aluminum soap base greases are reheated, even very gently, their texture usually changes, and the extent to which they return to the proper usable state depends upon the rate of cooling and the amount of agitation while cooling. For these reasons, aluminum stearate greases are not usually acceptable for bearings where the temperature is likely to reach 170° F., or above, even for short periods. These greases do, however, have a limited field of application because of their adhesive qualities and the fact that they are insoluble in water.

GROUP No. 6
LITHIUM SOAP BASE GREASES

Lithium soap base greases are the latest and one of the most promising developments in the field of greases. They have the smooth appearance of cup greases, yet the high melting point of sodium base greases, also, the soap is insoluble in water. During the present emergency they are being extensively used for the lubrication of aircraft control mechanisms, particularly at temperatures of 50° to 100° F. below zero.

Several methods can be employed to manufacture lithium soap base greases; however, so much secrecy has surrounded their development, due primarily to the war that only one method is universally known.

In this method, the lithium stearate, a white powder, and about half the oil that will finally be in the finished grease are heated in a fire-heated or high pressure steam-heated kettle to about 400° F. or slightly above. At this temperature the oil and soap become completely homogenous and almost transparent. The rest of the oil is then added and the heat turned off. The grease is stirred until it has cooled to the point found best for the particular mineral oil component and at this point agitation is stopped and the grease is cooled under conditions previously found most suitable, usually in pans or sometimes in the kettle itself. After cooling to room temperature, the grease is hard and perhaps a little brittle or crumbly, depending largely on the soap content. It is then put through a suitable agitator (milled). The hard gel is crushed and any lumps of gel are mashed homogeneously until the consistency reaches the softness desired. The grease is now of a smooth, buttery texture and has an attractive appearance, although the odor may at times be rather noticeable due to the high heat method of manufacture.

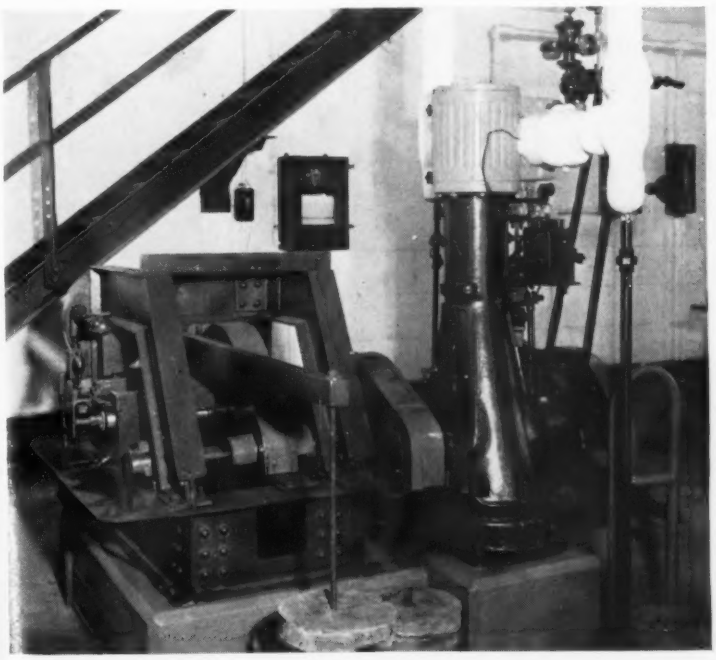
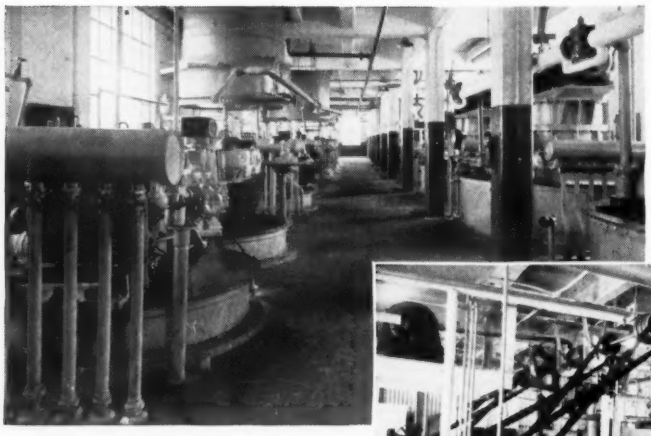


Fig. 12—Testing and evaluation of brick type greases. Pressure, temperature and speed can be controlled and consumption measured.

Obviously, the high temperatures required to make lithium stearate greases, as outlined above, offer definite hazards if it is desirable to use low viscosity oils having low flash points. Since it is necessary to use such oils in greases designed for use at 50° to 100° F. below zero, a method has been developed whereby such greases can be made at comparatively low temperatures in steam-heated kettles, and the resultant grease does not have to be milled after the grease is drawn.

A recent discovery has been the development of lithium soap base greases which are resistant to shear, that is, they will not work down to a liquid in bearings. This has previously been one of the major draw-



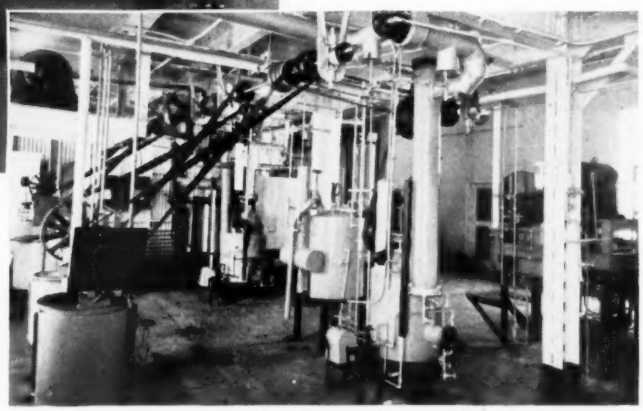


Fig. 13—Laboratory and plant grease kettles. Before the first plant size batch of a new product is produced, many laboratory batches have to be made before the right combination of ingredients and manufacturing technique are perfected.

backs of this type of grease. Development work remains to be done before these greases become more widely available. At the present time the only greases of this type on the market today are considered "specialties", designed for a specific purpose.

GROUP No. 7
MIXED BASE GREASES

Grease chemists for years have combined two or more types of grease into one product for the purpose of incorporating the better qualities of each. They have been particularly successful in combining sodium and calcium soaps to produce a smooth grease having a relatively high melting point (two desirable characteristics in a ball and roller bearing grease). In some cases, very small amounts of sodium soaps are added to cup grease as stabilizers, but such products are not usually considered mixed base greases.

A second example of this type of product is calcium-lead soap base greases. These are used where extreme pressure characteristics are desired.

Aluminum soap has been used in combination with other soaps to impart stringiness to the final product.

The method of manufacturing mixed base greases does not differ greatly from those shown for the types of soap involved. The two soaps are usually made simultaneously in the same kettle, and if, for example, the product desired is to be predominantly soda base, it is manufactured along the lines of fibre grease or if the lime base is to predominate, it will be manufactured as a cup grease.

SUPERVISION

No article on the production of greases would be complete without explaining the controls exercised by a manufacturer of greases. Modern grease plants are under the technical supervision of a grease laboratory, manned by technically trained men who devote their professional lives to the development and control of greases. It is the responsibility of these men to insure all raw materials used in grease manufacture meeting rigid specifications. It is their duty also to test and inspect each and every batch of grease made and to see that batch after batch of the same grease is exactly the same. Only through exacting laboratory controls can uniformity of product quality and performance be maintained.

CONCLUSION

The "rule of thumb" method, used until comparatively recently in the manufacture of greases has been superseded by modern scientific methods. Proof of the rigid quality control used by modern manufacturers is exemplified by the outstanding performance of greases in service.

During the war years, the demand for greases has increased enormously in volume and at the same time the diversity of application of those products available has increased. New products have been required and supplied where needed to meet a demand.

It should not be concluded that diversity of application has required a large number of new products. Knowledge of characteristics of greases in combination with scientific methods of manufacture and control are factors necessary to keep the number of products to a minimum and this is a desirable objective from the standpoint of the consumer. He does not find it necessary to fill his shelves with a separate product for each and every application.

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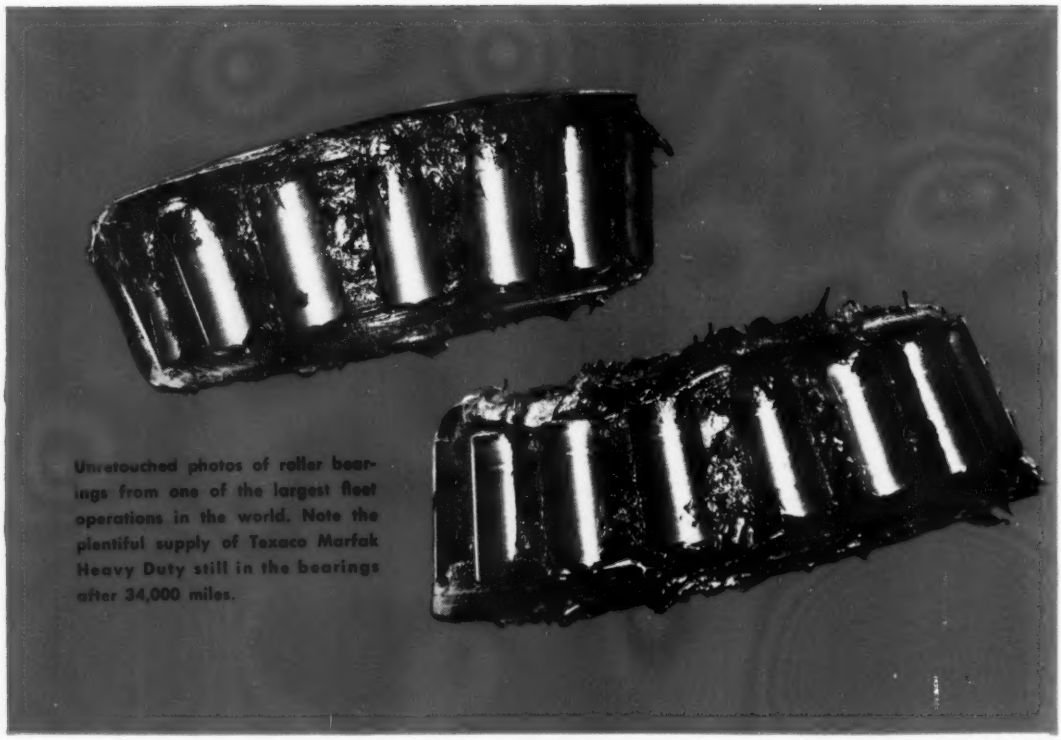

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